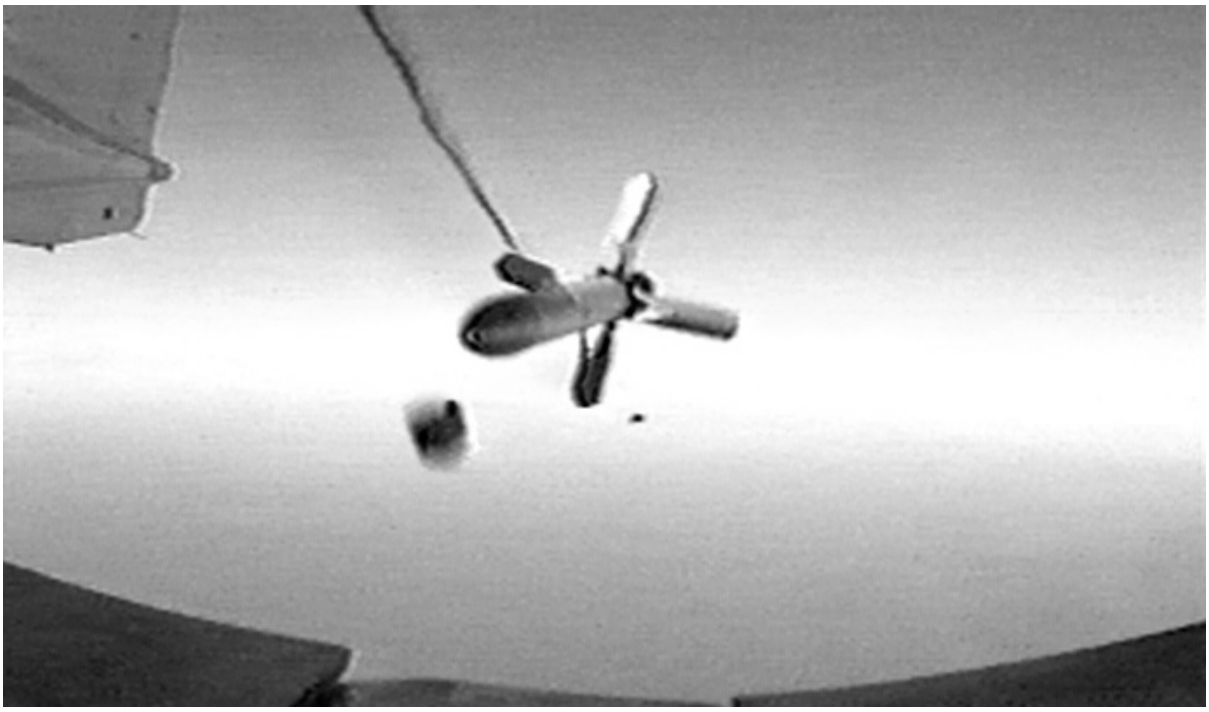
INTEGRATED DEFENSIVE ELECTRONIC COUNTERMEASURES (IDECM) AN/ALQ-214



Navy ACAT II Program

Total Number of Systems:	459
Total Program Cost (TY$):	$2.71B
Average Unit Cost (TY$)	
F/A-18 E/F:	$2.27M
B-1B:	$2.03M
F-15 (SCA only):	$0.10M
Full-rate production:	3QFY02

Prime Contractor

Sanders (Lockheed Martin)

SYSTEM DESCRIPTION & CONTRIBUTION TO JOINT VISION 2020

The Integrated Defensive Electronic Countermeasures (IDECM) program contributes to the ***Joint Vision 2020*** concept of ***full-dimensional protection*** by improving individual aircraft probability of survival.

The IDECM suite is intended to provide self-protection and increased survivability for tactical aircraft against radio frequency (RF) and Infrared (IR) surface-to-air and air-to-air threats. The major hardware component to be developed by the IDECM program is the IDECM radio frequency countermeasures (RFCM) system and the ALE-55 Fiber Optics Towed Decoy (FOTD), which can be trailed at varying lengths behind the aircraft to optimize RFCM techniques against threat missiles and tracking/targeting systems.

The RFCM consists of an on-board receiver/processor/techniques generator that stimulates FOTD or on-board transmitters for transmission of the countermeasure technique. Tailored RFCM techniques are generated onboard the aircraft and sent to the FOTD via a fiber optic cable or to on-board transmitters. FOTD is intended to be compatible with and deployed from the ALE-50 launch controller used with the advanced airborne expendable decoy (AAED).

IDECM will integrate specific electronic self-protection systems on the host aircraft. In addition to RFCM and FOTD for the IDECM lead aircraft (F/A-18E/F), these systems are defined as the radar warning receiver, the Common Missile Warning System, the AN/ALE-47 chaff/flare dispenser, and an off-board decoy launch controller/dispenser. In 2QFY99, the Navy decided to add an on board jamming capability to complement FOTD off board capability. Addition of an on board jamming capability will allow a full self-protection capability throughout the entire operational flight envelope of tactical strike aircraft. Even if operational maneuvers or engagements deplete the limited numbers of FOTDs carried, the platform will still have a capable self-protection suite.

Upon completion of its own OPEVAL, the Advanced Strategic Tactical Expendable is one of several expendables that may be dispensed by AN/ALE-47. Integration of the entire IDECM suite (ALR-67, ALE-47, FOTD, and RFCM) is intended to provide integrated threat radar warning, threat missile detection/warning, and optimized countermeasure response to increase survivability of the host aircraft against IR and RF threats

BACKGROUND INFORMATION

IDECM was intended to fill the electronic self-protection operational deficiency for Navy tactical aircraft beginning with the first F-18E/F operational deployments in 2002. USAF requirements for a common FOTD and techniques generator were included in the IDECM RFCM EMD contract. USAF has selected components of IDECM RFCM for integration into the B-1B Defensive System Upgrade Program architecture, and is planning integration of IDECM components into F-15 ALQ-135 Tactical Electronic Warfare System architecture.

In 1998, the IDECM program was re-baselined to fund an 87 percent development cost overrun and extend the development schedule by six months. Again, in April 1999, technical difficulties and cost overruns resulted in a second restructuring of the IDECM program by PEO(T). The resultant, new IDECM development strategy is a three phased, sequential approach intended to meet early operational deployment requirements and reduce risk of the development of the originally intended final IDECM suite. The three phases are:

Block I. IDECM Block I, is an interim F/A-18 E/F self-protection jamming suite consisting of the ALQ-165 (Advanced Self-Protection Jammer) and the ALE-50 Advanced Airborne Expendable Decoy. The Navy plans to use the IDECM Block I configuration for the first two F/A-18 E/F operational deployments only. IDECM Block I includes the five basic ASPJ WRAs (two receivers, two transmitters, and one processor), all upgraded through either Navy sustainment efforts and/or Foreign Military Sales (FMS) derived upgrades. The upgrades include FMS preamps (to improve receiver performance), a RF tunable filter (to improve ASPJ interoperability with the AI radar), and a new threat parametric User Data File.

Recalling that ASPJ was cancelled in 1992 after an unsuccessful OPEVAL, the path to becoming a component of IDECM Block I warrants brief review. Though cancelled, approximately 100 ASPJ

systems had already been procured by the Navy for the F-14D. Contingent upon satisfactory performance in an FOT&E of the F-14D, the Navy was allowed to field the system. Subsequently, in 1995, ASPJ offered the only rapidly available capability to improve F/A-18 C/D survivability against threats in the Bosnia/European theater of contingency operations. The Navy was allowed to procure 36 additional, improved ASPJ systems (made possible through an approved FMS program that kept the production line open). ASPJ development was consistently overseen by DOT&E throughout this evolution.

As mentioned above, in April 1999, IDECM technical challenges and schedule constraints led to a Navy decision to develop an on-board RF jammer to support initial F/A-18E/F deployments. F/A-18E/F was specifically designed and equipped to carry IDECM, with backwards compatibility for ASPJ as the on-board jammer. It was not economically feasible to modify the aircraft to carry another self-protection jammer. The Navy began integration of the first of the three-phase program to incrementally develop an on-board and off-board RF jammer system for F/A-18 E/F, with the first phase (IDECM Block I) using an upgraded variant of ASPJ. As stated earlier, the Navy intends the development and deployment of the IDECM Block I system as an interim capability until Blocks II and III successfully conclude their developmental and operational testing. An important aspect of this interim solution is the fact that the Navy did not procure logistics supportability for IDECM Block I beyond that necessary to field the system on the first two deployments.

Block II. IDECM Block II, a second interim configuration, will be comprised of the ALQ-214 (includes the on board jamming capability) and the ALE-50 towed decoy. This configuration is planned for the third F/A-18 E/F deployment.

Block III. IDECM Block III will be the final configuration, and will be comprised of ALQ-214 RFCM and ALE-55 FOTD. IDECM Milestone III is scheduled for 3QFY02. OPEVAL for IDECM integration with the Common Missile Warning System (CMWS) is planned subsequent to the CMWS MS III. CMWS integration in the F/A-18E/F will be supported through the IDECM Integration Milestone III in FY03. IDECM Block III will support the fourth and subsequent operational deployments of the F/A-18 E/F.

On a parallel schedule, the Navy conducted the F/A-18E/F OPEVAL from 3QFY99-1QFY00. Since F/A-18E/F OPEVAL was conducted before the more capable IDECM RFCM was available, F/A-18 E/F OPEVAL aircraft were not equipped with IDECM RFCM. It was equipped with the ALE-50 Launch Controller/Dispenser portion of IDECM Block I, including AAED, to fill part of the self-defense requirement in support of overall F/A-18E/F OPEVAL survivability assessment. DOT&E required the Navy conduct a separate Block I OT, which concluded in August 2000. F/A-18E/F FOT&E with IDECM RFCM is planned concurrently with OPEVAL for the RFCM, supporting RFCM Milestone III and B-LRIP in FY02.

TEST & EVALUATION ACTIVITY

IDECM Block I DT, Sep 99 through Feb 00, tested ASPJ installation, effectiveness and suitability on the F-18 E/F to include compatibility with other self-protection systems (ALE-50, ALE-47, and ALR-67(V3). The successful initial DT of IDECM Block I led to a combined DT/OT test, March to April 2000. In May, the Operational Test Readiness Review moved the program forward into dedicated OPEVAL. The program completed a four-month OPEVAL in August 2000. The operational effectiveness criteria for IDECM Block I was that it provide a measurable reduction in lethality for the

Block I equipped F/A-18 E/F as compared to an ALQ-126B equipped F/A-18 C/D.DT and OT included rigorous ground and flight test which included hardware-in-the-loop simulations and flights involving actual threat systems. COMOPTEVOR is finalizing test documentation and system assessment that DOT&E will follow with a BLRIP report evaluating test adequacy and confirmation of effectiveness and suitability. Since no new ASPJ systems are to be procured, the effect of the report is to comply with Title 10 requirements for operational test of the IDECM system, Block I version only, prior to deployment to the fleet.

IDECM Block II completed a limited DT Assist by operational test personnel in 4QFY00. The results indicated positive progress towards a Block II fielding in the third F-18E/F deployment in August 2003. Block III completed a limited (no on board transmitters) Operational Assessment (OA) in March 2000 where it was assessed to be potentially operationally effective and suitable.

The IDECM Block III RFCM OA was conducted in two phases. A hardware-in-the-loop (HITL) test versus a realistic threat system was carried out November 1999. The aircraft, missile flight path, and environmental effects were modeled using an uninstalled RFCM and FOTD to counter a missile in a radar anechoic chamber. The second OA phase was flight testing at NAWC-WD China Lake's Electronic Combat Range, carried out from February-March 2000. This test phase was an early look at the potential operational effectiveness and suitability of IDECM. By design, the test was limited to a non-production representative installation on the ATB aircraft using a reel-out, reel-in external pod to conserve decoys.

Test and evaluation activity of Block III during FY00 was beset by continued technical difficulties with the FOTD, and FOTD launcher assembly. Early developmental testing revealed that FOTD flight envelope and IDECM component interoperability issues were more difficult than expected. System development was at a much slower pace than expected, and led to a delay in the OA flight test until 2QFY00. Fast deploy (a rapid release and reel out to a specific distance behind the aircraft) testing was carried out on several platforms throughout FY00: Lear, Drakken (for early development work), F-16, F/A-18 E/F, and F-15. All aspects of system mechanical and electrical performance were evaluated. To resolve safety of flight issues caused by FOTD fins striking the underside of the aircraft, a fin delay mechanism was developed and entered into test. Developmental flight testing continued sporadically throughout the beginning of the fiscal year, slowing during the RFCM OA. System software and software integration appear to be on track, with two major blocks of software delivered this FY on or ahead of schedule. However, due to the by-design deployment of the FOTD in the area of the engine plume, the F/A-18 E/F continues to be the most difficult platform for IDECM. To characterize the thermal environment behind the aircraft, tests were conducted with a Tiger pod that uses a towline with embedded thermocouples. Early results showed unexplained temperature spikes in the towline.

Several efforts were made to improve decoy deployment and retention on the F-18E/F. Materials research studies on new fiber optic and towline strength member materials were continued, looking for materials that will improve the thermal and mechanical limits of the current towline. In addition, two efforts to improve the current version of the reel-out, reel-in pod for test use were begun. These improvements are needed to improve the rate of decoy re-use and expand the flight envelope over which the decoy can be tested.

The only approved TEMP is dated April 1999. It was approved by DOT&E with the condition that it was valid only through the IDECM RFCM OA and that the TEMP will be updated prior to the next test event. An Annex to the TEMP covering all Block I test efforts was approved in March 2000. The TEMP IPT is currently updating the capstone TEMP to include the complete three-phase approach to IDECM development (described above), testing, and introduction to the Fleet.

TEST & EVALUATION ASSESSMENT

The new three-phase development strategy and test planning have successfully mitigated some of the risk incurred over the last two years of IDECM evolution. As mentioned earlier, Block I is presently on track to support the first two F-18E/F deployments. The IDECM Block I test effectively re-baselined survivability of the F/A-18E/F. The limited nature of the supportability of the end product, however, is cause for some concern. The Navy has not sought to change or extend the ASPJ logistics support structure. The IDECM Block I system, by virtue of being an interim solution intended only for the first two F/A-18E/F deployments, has limited logistic supportability for the fleet. Follow-on IDECM blocks must produce an effective and suitable replacement to the Block I suite before its available logistics support expires. Block II successfully completed DT; recall, though, that operational test of Block II (including ALQ-214 RFCM, on board jamming, and ALE-50 towed decoy operation) is yet to be conducted.

Block III, with particular regard to the FOTD, towline, and deployment design, is still high risk. In the lab environment, the Block III RFCM and FOTD proved to be a highly effective system in numerous scenarios. Results in the OA HITL tests versus the realistic threat system were very positive and also very close to predicted results. Once the flight envelope in which the system could successfully deploy and maintain fiber optic continuity was determined, the IDECM OA flight test was successful. The results of the test proved – in the very limited maneuver, altitude, and airspeed regime explored – that the RFCM and FOTD could be effective against several distinctly different types of SAMs. However, the hardware and software installations were non-production representative and, therefore, little could be determined in the OA about suitability. Furthermore, reel-in/reel-out and towline improvements are not complete.

CONCLUSIONS, RECOMMENDATIONS AND LESSONS LEARNED

Several test range limitations hampered all blocks of IDECM testing. Threat simulators intended for use during the RFCM OA were not operational. One new test asset, the "Missile on a Mountain," used for testing a particular class of missiles, did not produce consistent miss distance data. Daily alignment variations of several of the threat simulators made analysis and interpretation of the results difficult. Furthermore, only a small number of threat assets available have accredited fly-out models that work in real time profiles. The Navy needs to invest in these test assets, to include valid fly-out models and accreditation of as many threats in the IDECM threat matrix as possible, in order to produce operationally relevant and credible T&E results for Block II and Block III variants.

With regard to the IDECM development strategy, the Navy needs to continue developmental efforts to produce a reliable IDECM system, solve decoy launch/flight envelope issues, and gain further insight on towline characteristics and failure conditions. The Navy needs to mitigate the risk that Block III will not be available for the fourth and subsequent F-18E/F deployments (January 2004 and beyond). Understandably, the service desires to plan for the success of the Block III program. However, a prudent plan must include an operational test of the Block II system, which would necessarily begin in FY01 with an early decision (i.e. at least prior to the beginning of OPEVAL) to do so. A rigorous and comprehensive operational test of the Block II configuration is required before fielding the system for interim use (the third F/A-18 E/F deployment), much less as what may turn out to be the final installment in F/A-18 E/F self-protection.